THE UNIVERSITY OF UTAH

March 31, 2016

Ruth V. Watkins
Senior Vice President for Academic Affairs
205 Park Bldg.
Campus

RE: Graduate Council Review
Professional Master of Science and Technology Program

Dear Vice President Watkins:

Enclosed is the Graduate Council's review of the Professional Master of Science and Technology. Included in this review packet are the report prepared by the Graduate Council and the Memorandum of Understanding resulting from the review wrap-up meeting.

After your approval, please forward this packet to President David Pershing for his review. It will then be sent to the Academic Senate to be placed on the information calendar for the next Senate meeting.

Sincerely,

David B. Kieda
Dean, The Graduate School

Encl.

XC: Ray Hoobler, Director, PMST Program

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The Graduate School - The University of Utah

GRADUATE COUNCIL REPORT TO THE SENIOR VICE PRESIDENT
FOR ACADEMIC AFFAIRS AND THE ACADEMIC SENATE

November 30, 2015

The Graduate Council has completed its review of the Professional Master of Science and Technology Program. The External Review Committee included:

Carol A. Lynch, PhD
Dean Emerita of the Graduate School
University of Colorado, Boulder

Deborah Silver, PhD
Executive Director, Professional Science Master's Program
Professor, Department of Electrical and Computer Engineering
Rutgers, The State University of New Jersey

Bogdan M. Vernescu, PhD
Interim Vice Provost for Research
Professor, Department of Mathematics
Worcester Polytechnic Institute

The Internal Review Committee of the University of Utah included:

Hank Bessembinder, PhD
Professor
Department of Finance

Steven Lobell, PhD
Professor
Department of Political Science

Cecilia Wainryb, PhD
Professor
Department of Psychology

This report of the Graduate Council is based on the self-study submitted by the Professional Master of Science and Technology (PMST) Program, the reports of the internal and external review committees, and the responses of the program director and Dean of the Graduate School.

PROGRAM PROFILE

Program Overview

This is the first Graduate Council review in the 13-year history of the Professional Master of Science and Technology (PMST) Program, which is administratively located in the Graduate School. The PMST is an interdisciplinary degree program that combines graduate training in science or mathematics with coursework in business management, communication, and quantitative skills, providing students with an opportunity to apply these coursework skills in an internship with a company, organization or governmental agency. The PMST curriculum is designed as two years of full-time study grounded in existing courses offered by academic science and technology departments and colleges across campus, in combination with the PMST core of transferable and advanced quantitative skills courses taught by instructors of the PMST program. Currently the four tracks in the PMST are Computational Science, Environmental Science, Science Instrumentation, and Biotechnology.

The PMST was initiated in 2002 with an award from the Alfred P. Sloan Foundation as one of the original 12 institutions to develop professional MS degrees in mathematics and science, which are now branded nationally as "Professional Science Master's (PSM)" degrees. Currently 343 programs at 129 institutions worldwide have been designated as PSM affiliates. Athough the University of Utah program had not renewed its PSM affiliation for some time prior to this review, an application for reaffiliation was recently submitted and the University was approved as a PSM affiliate in October 2015. The National Professional Science Master's Association (NPSMA) meets annually; while faculty from the University have not been regular participants, there is a recent commitment to support faculty participation.

The PMST program is managed by an executive committee, which is composed of the PMST program director (staff) and five faculty members (the PMST program relations director, who is also the dean of the Graduate School, and four science track directors whose academic appointments reside in home departments that correspond to the four foci in the College of Science and College of Mines and Earth Sciences). Program administration also includes a program coordinator. An external advisory board existed at the outset of the program but has not been convened since 2005. Currently a new advisory board of academic and business representatives is being constituted.

The program director resigned in July, 2015 during the response phase of this review process; an interim program director from the School of Business was appointed and a search has been initiated to fill the position.

Faculty

There are no academic lines (FTE) dedicated solely to the PMST program. The program relations director (Dean of the Graduate School) and three of the track directors are tenured faculty with academic appointments in their home departments within the College of Science. The other track director is a lecturer in her home department in the College of Mines and Earth Sciences. Although faculty involved in the PMST

program did not historically receive compensation for their contributions, beginning in 2012-2013 the track directors and the relations director started receiving a fractional salary (approximately 0.1 FTE). External and internal reviewers judged the track directors to be committed professionals who value the program, but external reviewers identified need for the track directors to have more knowledge about PSM programs nationally and developments in the field, noting that many of the problems identified by the track directors have been experienced in other PSM programs nationally that have developed ways to address the issues.

The former program director holds PhD and MBA degrees, but did not have a faculty appointment and hence did not teach courses in the program. No information was provided about the qualifications stipulated for the replacement in the program director position, although this position seems to have considerable influence on the implementation and evaluation of the academic components of the program. Both internal and external reviewers suggested that consideration be given to restructuring this position.

Adjunct instructors with expertise in the relevant business, management, or communication fields are contracted to teach the six 1-credit transferable skills courses and two required advanced quantitative skills courses required for all PMST students. All but one of these faculty (a business analyst who teaches a 1-credit module) have master's degrees or higher. Since the program is not conducted within a department with an appointments advisory committee, appointment and review of PMST faculty is apparently not congruent with the provisions of University policy 6-302. External reviewers who met with representatives of this group of adjunct faculty judged them to be dedicated and knowledgeable. Apparently none of the adjuncts met with internal reviewers. The self-study and program director response indicated that faculty with appointments in the David Eccles School of Business (DESB) are not selected to teach PMST classes because of higher salary costs than adjuncts, though reviewers urged greater involvement of faculty from DESB. Internship advisers at the businesses or agencies are critical to the success of the internship experience, and the need to expand the pool of advisers was identified in the self-study, but there was no discussion of their orientation or involvement in program development.

Three of the four track directors are female. One of the nine adjunct instructors engaged in teaching the PMST transferable skills courses and advanced quantitative skills courses is female. There is no discussion of racial and ethnic diversity of the instructors or track directors, although PMST students take at least 15 MST credits of the 36 required for the degree, so diversity of PMST faculty and leadership is relevant.

Faculty who teach the 200-plus graduate-level science courses taken by PMST are appointed by the departments. Discussion of faculty diversity, teaching, scholarship, and service were omitted in the self-study as faculty affiliated with the science components hold appointments in home departments that are reviewed individually. Some of these faculty also participate on internship supervisory committees; the need to expand the number of faculty participating in the internship from both scientific and business perspectives was identified as an important challenge for the program, particularly since internship advisory committees must have two tenure-line members. In general, the track directors and program director identified a lack of knowledge (and even antagonism) about the program among the academic department leadership and faculty who teach the science courses, and faculty are sometimes unaware there are PMST degree students in graduate courses they teach.

Students

Since the first class of 10 students matriculated in the 2002-2003 academic year, 146 students have graduated as of January 2015. According to data included in the self-study for the past seven years, 62% of entering students completed their degree within four years, 11% are in progress, and 27% left the program without being awarded a degree. The most common reasons for non-completion in this program were financial, family, and job demands, including scheduling of courses in conflict with work hours. In the years 2007 to 2013 there were 39 to 107 applicants per year and 18 to 39 per year enrolled. There appears to be a downward trend in both applications and admissions over the past seven years. The number of PMST students enrolled in the program between 2007 and 2013 averaged 58.3, with females constituting 35% (range 20.4-45.4) and racially or ethnically diverse students (Hispanic, Black, Native American/Alaska Native, Asian, Hawaiian/Pacific Islander) constituting 7.8% (range 4-12.3%).

The program is intended to be completed in two years, even though many students are employed full time and attend the program as part-time students. From 2010 to 2014, Environmental Science track (average 26 students) and Biotechnology track (average 17 students) matriculated the majority of the enrollment, followed by Science Instrumentation (average 10 students). The lowest enrollment is the Computational Science Track, with an average of just 4 students enrolled. The major current modalities of recruitment include the program's website, alumni networking, and graduate school recruitment fairs. The program does not provide financial aid to students, although some have tuition support from employers or foreign government (international students). In meetings with internal and external review groups, students suggested that more evening/weekend classes would attract more working professionals to the program and expressed need for improved advising in selection of elective courses. Areas for improvement identified by the self-study included developing a unified student recruitment approach across tracks, and access to financial aid for PMST students.

Curriculum

The PMST is a 36-semester-hour graduate degree consisting of four components: 9 credits of transferable skills--courses in business, management, and communication; 9 credits of advanced quantitative skills--courses in scientific reasoning and statistics and a track-specific advanced quantitative skills course; 15 credits of track-specific science and/or mathematics coursework in one of the four tracks; and a 3-credit internship. All PMST students take the core of six 1-credit MST transferable skills courses and two 3-credit MST quantitative skills courses, and the internship. PMST students also take 3 additional credits of each: transferable skills and quantitative skills; the remaining 15 credits are drawn from over 200 science and mathematics courses across science departments. Each track takes a distinct approach to the program of study and the track director manages, assesses, and updates the curriculum for each track. There is no mention of curriculum committee or faculty governance input into decisions about track curriculum.

The required internship (capstone) was identified in the self-study as a major success of the program. Students must identify an internship opportunity, submit a written proposal, assemble a supervisory committee comprised of three faculty members (2 tenure-line) with relevant expertise, and give an oral proposal presentation, clearly outlining the scope and expected deliverables of their project. Internships must be approved by the track director, the student's supervisory committee, and the internship supervisor at the company or organization. The final exam consists of an oral presentation and written report.

Curriculum opportunities identified in the self-study were revisions in the transferable skills core by consolidating courses and enlisting a single course faculty coordinator, as well as curricular revisions, particularly in the Computational Science track. Student concerns expressed to internal and external reviewers included need for more choices of transferable skills courses, difficulty experienced by some students in identifying an internship project, and need to simplify the process for selecting an internship adviser.

Diversity

Of the 14 faculty specific to the PMST program, 4 are female. There is no information on the ethnic and racial diversity of PMST faculty and leadership. Among students, women and ethnic and racial minorities make up 35% and 7.8% respectively. There is no plan for recruitment and retention of diverse students described in the self-study. In the self-study the major source of diversity is described in terms of nontraditional students who are employed and have prior professional experience, though it is unclear how this compares to other graduate students in the sciences.

Program Effectiveness and Outcomes Assessment

The self-study included an outline of processes for assessing program effectiveness and outcomes, but incorporated scant data beyond program completion data. External reviewers expressed concern that aside from assessment of individual course feedback, there is no systematic outcome assessment nor exit interviews. Although alumni surveys are conducted periodically, no data were provided; results of the most recent survey were unavailable at the time of the self-study and response rates were reported as low (13%). While analysis of the survey was completed before response to the internal and external reviewer reports, results were not provided in the program director response. Internal and external reviewers agreed on concern for percentage of non-completers, but differed on conclusions about whether the time to completion is of concern. For the four cohorts with more than two-thirds of admitted students graduated or withdrawn, the time to graduation averaged 6.3 semesters. Without some sense of the number of students who are part time, it is difficult to judge if there is a serious time to completion problem, since six semesters of part-time study to complete a four-semester program is not unreasonable. Nonetheless, the program director response to the internal and external reviewers outlined numerous barriers to timely program completion that duplicated the concerns expressed by students about the internship, advising, and course scheduling. Interviews with program staff and students indicated general satisfaction with the quality of placements of graduates from the PMST program, but no data on advancement or promotion within their existing jobs due to enrollment or completion of the PMST program are provided, nor is there any actual placement data provided.

Facilities and Resources

The PMST program is funded by university contributions, student credit hours productivity funding, and student per-semester fees ($500/semester). The program currently has two full-time positions, the program director and the program project coordinator, which is a support staff position. The Dean of the Graduate School serves as program relations director. Track leaders receive fractional salary for their leadership, although the supervisory burden is disproportionately heavy for the tracks with greater enrollment. Part-time adjunct instructors staff the transferable skills courses. The program has no TAs or RAs and does not provide funding for students or scholarships. External reviewers judged the size of the staff insufficient to conduct the program.

Physical facilities are conveniently located near the Science building, but the space consists of two small offices in an old building (Bldg. 44) in poor repair and located on different floors of the building. There is no space for students to congregate for networking and consultation, examinations, or meetings; these are conducted in the Marriott Library or the Graduate School offices. Alternative locations for the program have been proposed. External reviewers suggested that the program should be located in space that provides students with an identity for the program, creates a professional image to the external sponsors that conveys the impression that the University values and supports the program, and provides a cohort experience to students by facilitating interaction among students in all tracks.

COMMENDATIONS

1. The PMST program is exemplary in terms of its interdisciplinary nature and community partnerships, fulfilling a unique mission within the University.

2. The internship is highly effective and an excellent example of a best practice for a professional degree.

3. The participating faculty and staff have demonstrated commendable dedication to and support of the program in spite of limited resources and visibility within the University.

4. The Dean of the Graduate School has served with perseverance in the critical role of high-level administrative champion that is essential to a nontraditional, innovative program.

5. The PMST program is of high quality and has made important improvements to enhance quality, such as securing support for track directors, reconstituting the advisory board, becoming reaffiliated with PSM programs nationally, and supporting faculty participation in the national organization.

6. The four tracks leverage strengths of the affiliated colleges, meet critical societal needs, and provide important community partnerships that should be continued.

RECOMMENDATIONS

1. Work with the leadership of the University and affiliated colleges (Business, Science, Engineering, and Mines and Earth Sciences), as well as with the community partners, to secure requisite facilities, personnel resources, and organizational structure to assure sustained growth, maintenance of quality, optimal integration, and a curriculum that meets and anticipates industry needs.

2. Develop a comprehensive, systematic evaluation plan that drives continuous improvement of the program, including exit interviews, student progression and retention, alumni and employer follow-up, diversity, student satisfaction, industry trends, and congruence with national PSM trends.

3. Create strategies to market the program internally and externally, connecting the PMST program with internship and employment opportunities as well as enhancing diversity in student and faculty recruitment. Hiring an additional staff member is recommended to assist with these initiatives.

4. Improve student advising and support for the internship experience, sustaining the benefits of the cohort experience.

Submitted by the Ad Hoc Committee of the Graduate Council:

Ginette A. Pepper
Professor, College of Nursing

Bryan G. Trump
Assistant Professor, School of Dentistry

PROFESSIONAL MASTER OF SCIENCE & TECHNOLOGY (PMST) – OBIA PROFILE*

	R411 Data Table						
Professional Master of Science & Technology							
	Year	Year	Year	Year	Year	Year	Year
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Faculty							
Headcount							
With Doctoral Degrees (Including MFA and other terminal degrees, as specified by the institution)							
Full-time Tenured							
Full-time Non-Tenured							
Part-time							
With Master's Degrees							
Full-time Tenured							
Full-time Non-Tenured							
Part-time							
With Bachelor's Degrees							
Full-time Tenured							
Full-time Non-Tenured							
Part-time							
Other							
Full-time Tenured							
Full-time Non-Tenured							
Part-time							
Total Headcount Faculty							
Full-time Tenured							
Full-time Non-Tenured							
Part-time							
FTE (A-1/S-11/Cost Study Definition)							
Full-time (Salaried)							
Teaching Assistants							
Part-time (May include TA's)							
Total Faculty FTE							
Number of Graduates							
Certificates							
Associate Degrees							
Bachelor's Degrees							
Master's Degrees	15	7	15	18	24	11	13
Doctoral Degrees							

*Many fields are blank because of the interdisciplinary nature of the PMST program.

	Year 2007-08	Year 2008-09	Year 2009-10	Year 2010-11	Year 2011-12	Year 2012-13	Year 2013-14
Number of Students—(Data Based on Fall Third Week) Semester of Data: _____, 20__							
Total # of Declared Majors	50	59	70	67	57	56	49
Total Department FTE*							
Total Department SCH*							
*Per Department Designator Prefix							
Student FTE per Total Faculty FTE							
Cost (Cost Study Definitions)							
Direct Instructional Expenditures	$69,284	$105,382	$111,240	$119,962	$102,371	$89,235	$154,751
Cost Per Student FTE							
Funding							
Appropriated Fund							
Other:							
Special Legislative Appropriation							
Grants of Contracts							
Special Fees/Differential Tuition							
Total							

Memorandum of Understanding
Professional Master of Science and Technology Program
Graduate Council Review 2014-15

This memorandum of understanding is a summary of decisions reached at a wrap-up meeting on March 8, 2016, and concludes the Graduate Council Review of the Professional Master of Science and Technology (PMST) Program. Ruth V. Watkins, Senior Vice President for Academic Affairs; Ray Hoobler, Director of the PMST Program, David B. Kieda, Dean of the Graduate School; and Donna White, Associate Dean of the Graduate School, were present.

The discussion centered on but was not limited to the recommendations contained in the review summary report presented to the Graduate Council on November 30, 2015. At the wrap-up meeting, the working group agreed to endorse the following actions:

Recommendation 1: Work with the leadership of the University and affiliated colleges (Business, Science, Engineering, and Mines and Earth Sciences), as well as with the community partners, to secure requisite facilities, personnel resources, and organizational structure to assure sustained growth, maintenance of quality, optimal integration, and a curriculum that meets and anticipates industry needs.

The Senior Vice President mentioned several possible building options that might provide designated space to house the PMST offices and provide a communal gathering space for its students. The program director will follow up with the Senior Vice President to schedule a feasibility meeting. As for personnel resources, the program director and executive director (Graduate Dean) will conduct a market analysis to investigate implementing differential tuition in order to provide increased sustainable funding that will help to support program growth. New structural components are being considered, such as an entrepreneurial track, a computational track (joining with Mathematics and School of Computing), and a regulation track. Such collaborations would lead to more optimal integration and curricular relevancy to meet the needs of industry. Regular planning meetings between the program director and executive director are ongoing and an update report will be provided to the Graduate School.

Recommendation 2: Develop a comprehensive, systematic evaluation plan that drives continuous improvement of the program, including exit interviews, student progression and retention, alumni and employer follow-up, diversity, student satisfaction, industry trends, and congruence with national SPM trends.

Since the review took place, the PMST program has been reaccredited and funding has been budgeted for the director and executive director to attend national SPM meetings. The director is now working with OBIA staff to gather relevant data on the program that will assist in using assessment to continue to make data-driven decisions to improve the program. Exit interviews are currently being implemented and trends will be tracked to be used in curricular and other strategic planning and also for the next budget cycle (2017/18).

Recommendation 3: Create strategies to market the program internally and externally, connecting the PMST program with internship and employment opportunities, as well as enhancing diversity in student and faculty recruitment. Hiring an additional staff member is recommended to assist with these initiatives.

The new program director and executive director have made progress on this recommendation, including plans for such marketing tools as a PMST newsletter, reaching out to alumni, holding social events for current students and alumni, and other networking on the campus and in the community. The external advisory board is being reconfigured, strategies to provide diversity scholarships (using some of the differential tuition) are being explored, and the idea of a USHE-wide PMST program, an idea that was enthusiastically received by the Senior Vice President, is being considered.

Recommendation 4: Improve student advising and support for the internship experience, sustaining the benefits of the cohort experience.

As the program grows, there will be a need for additional staff support to address this recommendation, but currently the director is working with students and track directors to find ways for students to find more direct pathways to internships. The director will organize some meetings for the program track directors with the new director of the University College to ensure that best practices in student advising are being implemented. Directing students to existing resources on campus such as the Graduate Writing Center, writing courses offered through some departments (Linguistics and Writing and Rhetoric), Career Services, University College, etc., will also be helpful. When new facility space is in place, the cohort experience will have a better chance of being sustained as students will then have a place to gather and interact. Progress on this recommendation will be reported to the Graduate School in regular updates.

This memorandum of understanding is to be followed by regular letters of progress from the Director of the PMST Program to the Associate Dean of the Graduate School until all of the actions described in the preceding paragraphs have been completed. In addition, a three-year follow-up meeting will be scheduled during AY 2017-18 to discuss progress made in addressing the review recommendations.

Ruth V. Watkins
Ray Hoobler
David B. Kieda
Donna M. White

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David B. Kieda
Dean, The Graduate School
March 31, 2016